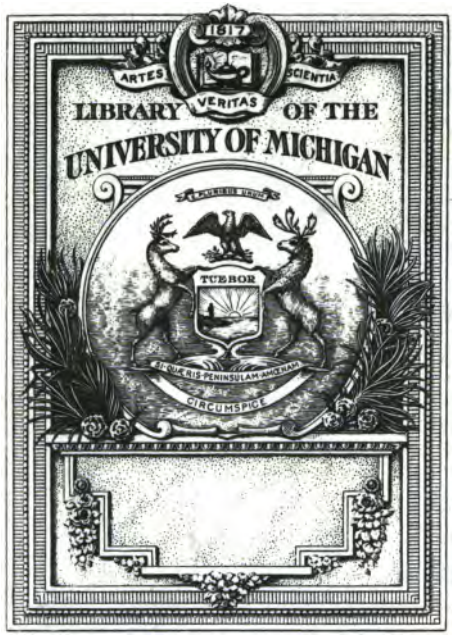


International Fisheries Exhibition

LONDON, 1883

COARSE FISH CULTURE

BY

R. B. MARSTON

EDITOR OF THE FISHING GAZETTE, MEMBER OF THE EXECUTIVE COMMITTEE OF THE NATIONAL FISH CULTURE ASSOCIATION.

LONDON

WILLIAM CLOWES AND SONS, LIMITED

INTERNATIONAL FISHERIES EXHIBITION

AND 13 CHARING CROSS, S.W.

1883

International Fisheries Exhibition,

LONDON, 1883.

CONFERENCE ON 29TH JUNE, 1883.

MR. THOMAS SPRECKLEY (Chairman of the Thames Angling Preservation Society) presided. In introducing Mr. Marston, he said he was a gentleman who had descended from the higher realms of piscatorialism on this occasion; for, though he was a trout and salmon fisherman, he had now come to tell them what he knew of the coarser kinds of fish, which give great pleasure to tens of thousands of their poorer brethren as anglers who could not afford to fish for trout or salmon. He himself knew very little of what was called the science of fish breeding, but he believed that no one could feel more than he did the necessity of protection for the fish. He had seen rivers where you could scarcely get a fish worth taking, and yet when he had four or five miles under his care, at the end of four years, without the aid of anything foreign, simply by protection, by having a book of rules and laws, it had been so improved that the last time he fished there he took a jack of eleven pounds, and three over seven pounds, besides smaller ones which he put back. At the same time he never refused permission to fish but once.

COARSE FISH CULTURE.

Before proceeding to give you some description of the various methods in which what are generally, but I think incorrectly, termed coarse fish may be propagated, it may be well to point out as briefly as possible the reasons why they should be propagated.

This is the more necessary because the majority of those who are interested only in the Salmonidæ, as a rule consider all other fresh water fish as useless, or worse than useless. As a trout angler myself, and much preferring that branch of sport to any other, I am perfectly ready to admit that coarse fish of almost any kind, in a trout or grayling stream, are indeed worse than useless. That there are circumstances, however, in which coarse fish are not only useful, but extremely valuable, I hope to be able in the course of my remarks to demonstrate to you.

There is a maxim, attributed I think to Jeremy Bentham, for which I have always had great respect, "The greatest good of the greatest number." I take this to mean that though a thing may not be good for all, yet if it be for the benefit of the majority its *raison d'être* is established. There are many thousands of anglers in this country, how many thousands it is difficult to say, but the fact that the vast majority of them are coarse fish anglers is beyond question. In London and Sheffield alone there are some twenty thousand coarse fish anglers enrolled as members of angling clubs, and in addition to these there are many thousands who fish only for coarse fish who do not belong to any club. I will not enlarge on this matter of the vast number of coarse fish anglers, because my friend Mr. Wheeldon is preparing an exhibition handbook on the

angling clubs of London and the provinces, and I am sure that the statistics he will give you respecting their number, nature, and organisation will astonish and interest you, and fully bear out the statement that of the two classes of anglers, those who fish for salmon and trout and those who fish for other fresh-water fish, the latter are by far the most numerous.

The first reason, then, why we should cultivate coarse fish is because they afford sport and healthful recreation to many thousands of our fellow men—the majority of them being working men who have neither means nor opportnnity for trout or salmon fishing.

The second reason is one which I think will be new to many of you, and it has the advantage of recommending itself strongly, I think, to all who are interested in the culture of Salmonidæ. This highest branch of pisciculture has been brought to such perfection that, as we were informed in the admirable paper on the subject read by Sir James Maitland last week, fully ninety-five per cent. of eggs can be successfully hatched and reared by artificial means. But to rear Salmonidæ successfully in captivity * you must feed them, and the question of food is an all important one, inasmuch as on it depends in great measure the quality of the fish and the price at which they can be profitably sold. The trout, I need scarcely tell you, is a fish of prey, provided by nature with a capacious mouth armed with rows of sharp teeth, and it is a fact well known to trout anglers that large trout feed almost exclusively on smaller trout and other fish.

I am indebted to Dr. Zenk, president of the Unter-fränkischen Kreisfischerei-vereins, for the suggestion that

* By "in captivity" I mean those cases where a large number of trout are kept in a small body of water, in which they would starve unless food is provided for them.

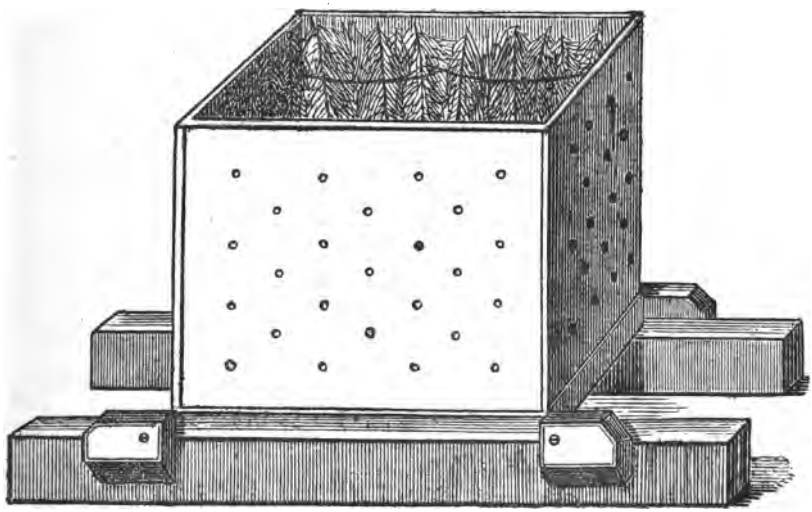
coarse fish can be most advantageously cultivated with a view to obtaining food for Salmonidæ. Dr. Zenk, who had hoped to have been present with us to-day, is the proprietor of one of the largest fish-breeding establishments on the continent, viz., that of Zeewiese, near Gemünden in Bavaria. The fishery comprises about thirty miles of water, including a portion of the river Saale well stocked with coarse fish, almost the whole of the Schondra, with many smaller brooks stocked with trout and grayling. I may mention that Dr. Zenk entertains no doubt whatever as to the possibility of breeding almost infinite numbers of any kind of coarse fish, and some of his ponds are devoted entirely to the cultivation of coarse fish for the purpose of obtaining food for his vast stock of Salmonidæ.

I will now pass on to the practical part of my subject, and endeavour to describe to you the various ways in which coarse fish, or, as they are called in Germany, summer spawning fish, may be propagated.

It must be borne in mind that it has not been found possible to cultivate these fish in the way that the Salmonidæ are cultivated. It is not only difficult to manipulate the eggs in troughs and trays, but the difficulty of rearing the young fry is even much greater. They are hatched out as perfect fish, at once requiring extraneous food, and they are so extremely small that all attempts to feed them artificially have failed. They appear to require that as soon as they leave the egg they should be able to seek their own sustenance on the almost invisible animalculæ present in their native waters. But to cultivate these fish artificially is not only difficult, but unnecessary. All that is necessary is to aid nature to a certain extent by placing parent fish in suitable places for spawning, and then protecting the eggs until the fry hatch out.

We have here some diagrams, which were kindly prepared for me by my friend Mr. Hobden, to illustrate a Paper on this subject which I read last year to a meeting of London anglers at the Society of Arts Room, on which occasion Mr. Birkbeck very kindly took the chair. The outcome of that meeting was the establishment of the United London Anglers' Fisheries Association, to which I shall refer presently, and whose objects are to obtain suitable fishing waters for the London anglers, and to stock them with fish.

This diagram represents what is known in Sweden as



LUND'S HATCHING BOX.

Lund's hatching-box. It was invented more than a hundred years ago by a Mr. Lund, of Linköping. The Swedish inspector kindly furnished me, in February last year, with information about this box, which is in general use in Sweden. He says:—"Replying to your letter of the 25th of February, in which you request me

to give you some particulars respecting Lund's hatching-box for the propagation of summer-spawning fish, I herewith hasten to give you all the information I can. Lund's apparatus is remarkable on account of its being, for aught I know, the first attempt in Europe to promote the propagation of the above-mentioned fish with human assistance. As you rightly suppose, the box is to be placed in shallow water near the bank, so that the water does not flow over it. Lund has not given any dimensions for his box, which may be of any size. The sides are hinged, so that they can be let down, and they are perforated with numerous small holes, so that the water can circulate through. The inside should be charred by fire to preserve it. The bottom of the box and the sides are lined with fir branches. As you will see from the sketch I send you, the box should rest on blocks, so as to be raised a little from the bed of the water. With some modifications—for instance it is not necessary to have the sides hinged—Lund's box has been adopted here in Sweden with success, and, in my opinion, for the hatching of perch, it is the most practical that has yet been invented. In a box of this kind, 6 feet square, and with sides 2 feet high, we place fifty female and from twenty to thirty male fish. These fish must be placed in the hatching-box as near their spawning time as possible, and are taken out again as soon as the spawning is finished. The fish deposit the spawn on the branches. It is of great importance that the sides are well perforated, to ensure free circulation of the water. We use these boxes chiefly for perch, but they can also be used, with some modifications, for other fish."

You will see, gentlemen, that it is an easy matter to transport spawn which has been obtained in this way to almost any distance, as it adheres to the boughs; so that

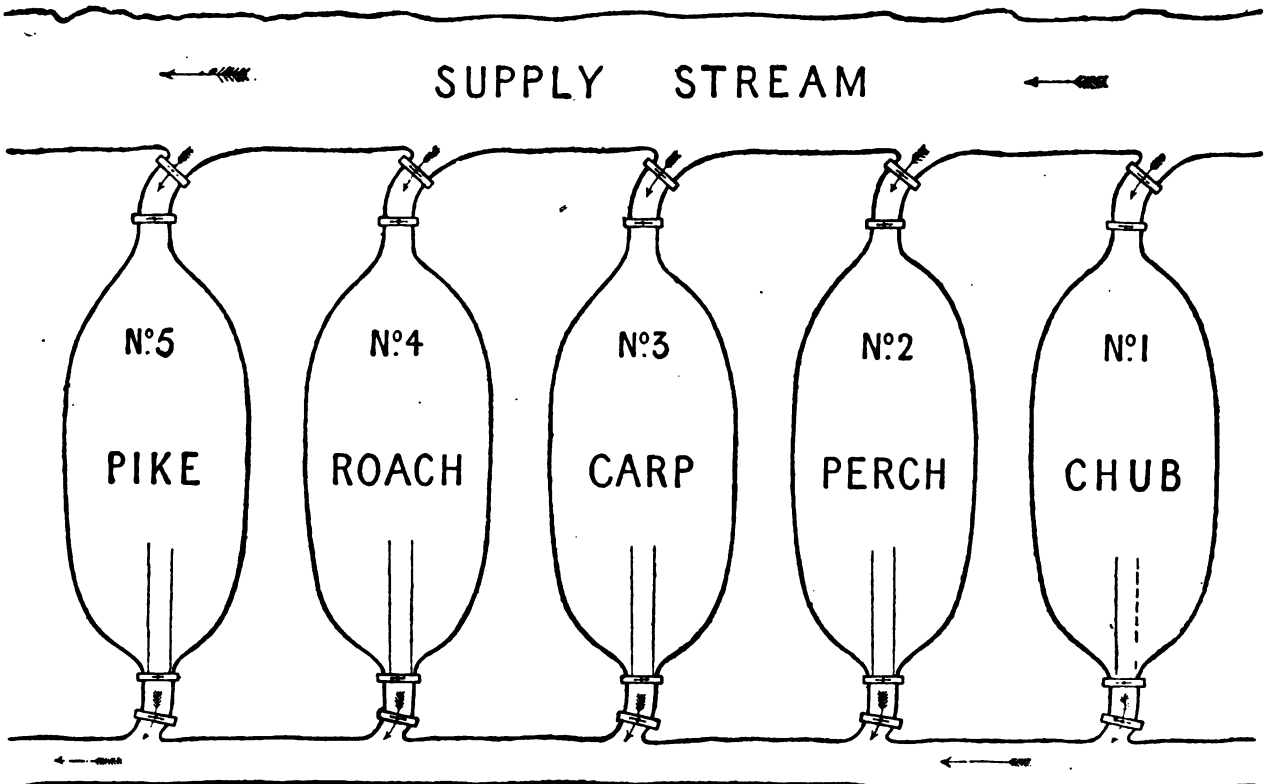
you can either let the fry develop in the box, and then go free in the water you desire to stock, or you can carry the fertilised spawn to some place, perhaps a hundred miles away, and then place it in a similar box in the water you desire to stock. In a week or ten days' time the fry will hatch out in countless numbers, and must then be liberated and allowed to begin their fight for life alone. In the Swedish exhibit in the present Exhibition, you will see some models of Lund's box. Here is one which the Swedish Commissioner has very kindly lent me to show you to-day. These models were exhibited in the Berlin International Fisheries Exhibition, and are thus referred to, in the German Official Report on that Exhibition, by Dr. Haack, director of the great fish breeding establishment at Huningen. In dealing with the Swedish exhibit he says:—"In the Swedish exhibit there were two insignificant-looking models, which were quite overlooked by the majority of visitors, but which were of the very greatest interest to every thinking pisciculturist. These models, in spite of their simplicity and insignificance, show us the way we, in future, most simply, easily, and inexpensively may carry on the propagation of our summer-spawning fish to any extent." He then describes the manner in which the box is used, and refers to its advantages as follows:—"As will be evident to every one, the eggs which have been deposited and impregnated in the box develop in a perfectly natural manner . . . air, light, and sun are able to exert their influences on the eggs in exactly the same way as if they had been deposited on water-plants in the open water in the ordinary way. Wind and waves can in like manner exert their beneficial influence on the eggs, which at the same time are protected from the violence of the storm, from which cause alone millions of eggs are frequently destroyed in the open water. The sides of the box and the branches

effectually prevent this destruction." Further, the numberless enemies of the egg are shut out, for by placing a piece of wire netting over the top, the ravages of swans, ducks, and wild fowl—those great destroyers of spawn—are provided against. When I described Lund's box to the meeting at the Society of Arts Room last year, to which I just now referred, its manifest advantages for coarse fish culture were fully appreciated, and a society was formed, of which I am glad to see we have here present to-day the President, Mr. Philip Geen, and the Hon. Secretary, Mr. T. Hoole. This society was formed with the object of renting waters and stocking them with fish, and it decided this spring to experiment with Lund's box. Six boxes were made and used, and I think I may say that in spite of some errors inseparable from a first experiment of this kind, they proved fairly successful. Spawn in large quantities was deposited in some of the boxes, and large quantities of fry were afterwards observed in and around them. The only difficulty experienced was in obtaining the parent fish, but as I trust the gentlemen who had charge of these boxes will give us some account of their experiences, I will not refer to them further than to mention that in a box the Society kindly lent me, and which I hope to make better use of next year, I placed one female perch, of about three quarters of a pound, and two very small perch. After about ten days I found a band of perch spawn containing many thousand eggs in the box, but as they remained unfertilised for want of male fish, of course they perished. I tried everywhere to obtain perch just before they spawned, but was unsuccessful. But from what I have seen of its practical working, I am perfectly assured that, provided you can get an adequate stock of parent fish, the Lund box is a most admirable contrivance for obtaining any quantity of fry.

Another, and in some respects even more simple contrivance for breeding these fish, is the breeding-hurdle. It consists of an ordinary hurdle, on which branches have been intertwined; it is sunk in a pond, lake, or stream, in any shallow undisturbed spot, and the fish find it a convenient place on which to cast their spawn, which can then be taken out and transferred to other waters, or left to hatch out. It is chiefly advantageous where natural spawning places are deficient, and is used to a considerable extent in France and Sweden.

Where some primary expense is not a matter of consideration, the next method I shall describe to you is perhaps the best and most satisfactory of all. I refer to the pond system of cultivation, which is carried on to such an enormous extent in Germany. The diagram (p. 12), most kindly made for me by Mr. G. A. Audsley, represents a small coarse fish farm, such as I venture to suggest might be most advantageously instituted by the National Fish Culture Association, for the purpose of hatching and rearing fry of all kinds of coarse fish, for distribution to angling clubs and private individuals requiring these fish. I am so often asked by secretaries of angling clubs and others where they can obtain coarse fish for stocking their waters, that I feel certain if the association was in a position to supply the fry of coarse fish in large quantities, the demand would be very large indeed. What holds good in the case of Salmonidæ will equally hold good in the case of coarse fish, for to one angler for the former fish there are a hundred anglers for the latter. It will be seen from the diagram that in the arrangement I propose each pond, although supplied from the same stream, is entirely separate from the others. The water flows from the river into the pond, and from the pond into the waste water stream. It would be almost impossible if the water flowed from one

SUGGESTION FOR COARSE FISH FARM.



's.—The ponds can of course be of any dimensions, according to requirements—50 yards
'g by 25 broad would be a convenient size. The faint lines at the lower end of the
nds represent a drain as deep as the deepest part of the pond, so that all the water can
drawn off when necessary.

pond into the next, as is the case in trout-breeding ponds, to keep the various kinds of fish distinct. The fry are so small that they will find their way through the finest grating, and it would manifestly never do to send a customer who had ordered roach, bream, or carp fry, a number of young pike or perch as well! The ponds, and the amount of water passing through them, should of course be adapted to the nature of the fish to be reared in them, and only one kind of fish, or fish similar in their habits, should be bred in a pond. As an instance of what may be accomplished with coarse fish in this way, I may mention that last spring Herr Max von dem Borne, the well-known German pisciculturist, placed about five hundred carp (spawners and milters) in one of his ponds, and in the autumn, when he drew the water off before a large company he had invited to witness the result, more than eighty thousand fine young carp were found.

I have referred to the difficulty experienced in obtaining parent fish for breeding purposes; there are hundreds of streams and other waters in this country which contain coarse fish, which are considered by the proprietors of these waters as, I was going to say, vermin; at any rate, they do all they can to get rid of them, to make room for their trout and grayling. Now I venture to suggest that the United London Anglers' Fisheries Society, and the National Fish Culture Association, would find this a most profitable field to work. I am perfectly certain that the proprietors of trout and grayling fisheries would be only too glad to give these societies all the coarse fish they could catch in their waters, and the very finest pike, perch, chub, roach, &c., are those which are bred in a trout stream. The expense of netting and fish-carriers would not be great. I am led to make this suggestion because, when on a trout-

fishing excursion, I have often thought how welcome these shoals of despised coarse fish would be if transported to some of the depleted waters fished by London and other coarse fish anglers. Our worthy and much-respected chairman, Mr. Spreckley, President of the Thames Angling Preservation Society, and the other officers of that society, have done a grand work of this kind by netting the reservoirs of the water companies along the Thames and other waters, and turning their stores of fish into the Thames.

Having described the methods in which coarse fish culture may be carried on, I will now, with your permission, give a brief general account of the natural conditions under which some of these fish breed—to give a complete list would occupy too much time. In coarse fish culture the more closely we follow the conditions laid down by nature, the more likely are we to meet with success. Being fully aware of the scantiness of our knowledge respecting the breeding of many of our coarse fish, I wish to disclaim any pretension to complete accuracy in what I state respecting this matter. I have got my information, such as it is, partly from personal observation, and partly from foreign works which refer to the subject.

SPAWNING TIMES OF COARSE FISH.

Nature of places they choose, and time it requires the young to hatch out.

The Pike spawns in February and March; the eggs, which are small, hatch in from fourteen to twenty-one days, and are deposited on mud, rushes, sedges, and other water plants in shallow quiet bays and ditches. The parent fish usually go in pairs.

The Perch spawns from March to May; the eggs, which hang together in bands like rows of beads on a coral necklace, are very small at first, but gradually swell, and the young fish escapes in from ten to twenty days according to the temperature of the water. The eggs are deposited on water plants and submerged boughs, and are then fertilised by the milt of the male fish.

The Loach spawns in December and January; the eggs, which are deposited on gravel in running water, hatch out in from thirty to forty days.

The Carp spawns in May and June; the eggs are deposited on water plants, and hatch out in from fourteen to twenty days. There are three kinds of carp; the common carp, which is covered with large scales; the mirror carp, which has one row of very large scales along the back, and another along the side, the rest of its body being covered with a leather-like skin free from scales; and the leather carp in which scales are entirely absent. Specimens of the two last-named fish, which are not common in England, can be seen in the aquarium of the Exhibition.

The Tench is another powerful and handsome pond fish which would well repay cultivation. It prefers stagnant and weedy waters. Like the carp and eel it buries itself in the mud in the cold months. Its food consists of larvæ, water plants, and worms. Like carp and all other muddy-flavoured fish, it eats well, and loses the muddy flavour if kept for a time in clear running water. It spawns from May to July on water plants, and the young fish hatch out in a week or ten days.

The Gudgeon, Minnow, Loach, and Bullhead spawn from May to July, selecting very shallow streams, and depositing their eggs on the gravel and stones. These fish

all form admirable food for Salmonidæ, and can be easily cultivated in any small clear stream.

The food of the carp consists chiefly of the larvæ of water insects, worms, sprouts of water plants, and decaying vegetable matter. Kitchen refuse forms very fattening food for carp. To rear carp with the greatest success the parent fish should be placed in a suitable pond in which there are no other fish; they spawn in May and June; the parent fish should then be netted out, and in the autumn, under suitable conditions, there will be an immense crop of young carp from two to three inches in length. The carp is a powerful fish affording great sport to the angler, and its cultivation might be most profitably carried on in England. In fact before the advent of Protestantism in England fish stews for the natural propagation of carp and other fish were very common.

The *Roach*, *Rudd*, and *Bream* spawn in May or early in June on water weeds; the eggs hatch out in a week or ten days.

The *Chub* spawns at the end of April or beginning of May, on shallow sandy or gravelly places, and the eggs hatch out in a very short time.

The *Barbel* spawns on stones and gravel, in a sharp stream from one to three or more feet deep; how long the eggs take to hatch out I have not been able to ascertain, but probably in a week or ten days.

The *Dace* spawns in March or the beginning of April, also in sharp shallow streams. There are some valuable foreign coarse fish which I think might be advantageously introduced into this country; but as my friend Mr. Oldham Chambers is to give us a Paper on the acclimatisation of foreign fishes, I will only refer to one of these, viz. the American black bass, because this fish—thanks chiefly to

the great interest taken in it by the Marquis of Exeter—may be said to be acclimatised here already. There are probably many thousands of them now in the fine sheet of water called White-water, near Burleigh House, Stamford, the country residence of his lordship. In 1878 and 1879, Mr. Silk, the able pisciculturist to the Marquis, brought over from the United States nearly one thousand young bass; and he informs me that the fish have spawned the last two or three seasons. Last year Mr. Silk was sent to the States to obtain a further supply of these fish, and they were distributed among some half-dozen gentlemen who had subscribed towards the expenses of getting them over. I received thirty of this lot, ranging in size from one and a half pounds to a few ounces, and they appear to be doing very well in a small sheet of water in which I have placed them. Having for some years past strongly advocated the introduction of this fine game and food fish into suitable English waters, I was, in common with others interested in this fish, extremely sorry to see, from the reports in the papers, that Mr. Goode, the United States Commissioner, had "warned English anglers against the black bass." I felt convinced that Mr. Goode did not intend to warn us against the introduction of this fish into *any* of our waters, but only such as were suitable for Salmonidæ. Knowing that an expression of opinion on this matter from so high an authority would have very great weight in this country, I wrote to Mr. Goode to ask him if he intended his remarks to apply to the introduction of the fish generally. His reply was exactly what I expected it would be; and I have very great pleasure in reading it to you, because it will do far more to remove any prejudice against the introduction of the black bass into *suitable* English waters than anything I can say :—

Mr. Goode says:—

"DEAR MR. MARSTON,—I am much annoyed—with myself chiefly, for I ought to have expressed myself more explicitly—that my remarks upon the black bass were so misinterpreted. I was speaking solely in reference to planting black bass in salmon streams, and in comment upon Sir James Gibson Maitland's paper upon the culture of *Salmonidæ*. The entire drift of my remarks was to the effect that the black bass is a fish with which public fish-culture had nothing to do, being purely an angler's fish, and not one which professional fishermen can take in large quantities for the supply of the public markets. As an angler's fish I believe the black bass to be superior in every respect to any fish you have in Great Britain outside of the salmon family, and I believe that its introduction into streams where pike, perch, roach, and bream are now the principal occupants, can do no possible harm, and would probably be a benefit to all anglers. It is also well suited for large ponds and small lakes, where there is an abundant supply of 'coarse fish,' which a school of them will soon convert into fish by no means 'coarse.' If you will kindly refer to my 'Game Fishes of the United States,' p. 12, you will find that my views as to the value of the black bass in my own country are already on record, and I can see no reason why this fish should not be equally valuable in Great Britain. I quote from my own essay as follows:—

"'Fish culturists have made many efforts to hatch the eggs of the black bass, but have never succeeded. . . . This failure is the less to be regretted since young bass may easily be transported from place to place in barrels of cool water, and when once introduced they soon multiply, if protected, to any desired number. The first experiment in their transportation seems to have been that of Mr. S. T. Tisdale, of East Wareham, Massachusetts, who, in 1850, carried 27 Large-mouths from Saratoga Lake, N.Y., to Agawam, Mass. The custom of stocking streams soon became popular, and, through private enterprise and the labour of State commissioners, nearly every available body of water in New England and the United States has been filled with these fish, and in 1877 they were successfully carried to the Pacific coast.

This movement has not met with universal approval, for by the ill-advised enthusiasm of some of its advocates a number of trout and bream have been destroyed, and complaints are heard that the fisheries of certain rivers have been injured. The general results, however, have been very beneficial. The black bass will never become the food of the millions, as may be judged from the fact that New York market receives probably less than 60,000 lbs. annually; yet hundreds of bodies are now stocked with them in sufficient numbers to afford pleasant sport and considerable quantities of excellent food. 'Valued as the brook-trout is for its game qualities,' writes Mr. Halloch; 'widely distributed as it is, and much extolled in song as it has been, the black bass has a wider range, and being common to both cold and warm waters, and to northern and southern climes, seems destined to become the leading game fish of America, and to take the place of the wild brook-trout, which vanishes like the aborigines before civilization and settlements.'"

"I shall try to be present at the reading of your paper on Friday, but fear that I may be detained by another engagement. I shall be very glad, then, if you will quote this letter as fully as your space will allow, in justice to the black bass and its advocates, as well as to myself.—I am, sir, yours truly,

"G. Brown Goode,
"*Commissioner.*"

I am sure, gentlemen, nothing could be more satisfactory than this letter. As an enthusiastic angler for all kinds of fish, I should be the last to advocate the introduction of a fish which would spoil our sport. Nor would I have anything to say for it if it were a fish like the trout, affording sport chiefly to the rich; but the black bass is essentially a poor man's fish; it will take any kind of bait freely, affords superb sport, and thrives best in just those waters which are not suited to trout and salmon, viz., ponds, lakes, and slow, deep streams.

In conclusion, gentlemen, I thank you sincerely for the

patient and kind manner in which you have listened to my Paper, and I trust that some of the facts I have given you in connection with a subject which is really of vast importance to many thousands of anglers, viz., the increase of our sport-affording coarse fish, will counterbalance to some extent the deficiency of my Paper in other respects.

DISCUSSION.

Mr. J. C. BLOOMFIELD said, coming from Ireland, he should like to say a word or two upon this matter. Like the Chairman he had been for many years endeavouring all he possibly could to protect fish; and possibly there might be some present who had come across, at Lough Erne, in the north of Ireland, the results of his labours. He had been a salmon and trout fisher himself, and no one would wish to associate them with such fish as they were dealing with to-day. But he agreed with Mr. Marston that you could not touch anything that was of more importance to the country than this coarse fish question. In this country there were a vast number of poor people who visited the different ponds and small rivers for the purpose of angling, and no one would grudge them the pleasure and the exhilaration they would feel on those occasions, and which they appreciated all the more from the confined nature of their occupation during so many months of the year. The salmon fisherman who knew what it was to have a twenty-pound fish at the end of his line must be a churl if he would not like to see a ten-pound pike at the end of the line of his poorer brother. He had in his mind's eye a spot in the north of Ireland where, from one hill, you had a view of twenty-seven mountain lakes all containing pike,

perch, roach, or trout. He was not sure that it was worth preserving the trout, because, although there was sufficient running water for them to live in, they were not in good condition for the table. But of those twenty-seven lakes not five pounds'-worth of food was taken out of them from year's end to year's end. If some of their German and French friends had those lakes, what would they make out of them? The fact was there were millions of acres of water in Ireland lying neglected. A man in Manchester who took all his rabbits for two years, came over, and saw him one day drawing for bream. In one day he brought out about twelve tons. He was very much astonished, and said there were a great many Irishmen in Manchester and Liverpool and there was not one of them who, at certain times of the week and many times of the year, did not want fish, and if these fish could be sent to Manchester, he should be very glad to pay well for them. That showed the desirability of the cultivation of these coarse fish. It would be an immense benefit to numbers of poor people whose conscience did not allow them to eat meat at certain times and who could get nothing else. London was the great centre, as he hoped it always would remain, of Imperial interest, and they had all been delighted to see the interest which had been taken in this matter by their Royal Highnesses the Prince of Wales and the Duke of Connaught; but he hoped that the interests of Ireland would not be left out in the cold.

Mr. MANN, as a fish culturist from the age of fifteen, could not allow Mr. Marston's Paper to pass without offering him a tribute of thanks for the information he had conveyed. Ten years ago he should have objected that the cultivation of coarse fish was not necessary, but when he came to think of the enormous increase of rod-

fishers, the steam-launches on the Thames, and the enormous interest some people seemed to take in the introduction of swans, Brent geese, ducks, and other individuals which shovelled up ova when deposited in the spawning-beds, he was free to confess that two years ago he withdrew unreservedly his opposition, and as far as it lay in his power he should be happy to give any association with which Mr. Marston was connected his utmost support. Mr. Chambers' fish box was like Lund's, only that the sides were covered with galvanised wire, the insides being lined with the points of the pine. He remembered one day in his sixteenth year, having got tired of fishing he turned up his sleeves and went along the bank trying to catch a few cray-fish. He came to the roots of an old willow-tree, and there discovered large rods of spawn attached to and intermingled amongst the roots of the willow. He got the man who was with him to cut off the roots, put them in his bait tin, and took them home and put them into a pond through which flowed a slight stream of water. Every morning he examined these under the microscope, and was delighted to see the gradual development of the perch. The recollection of the fact suggested to him, when he saw Mr. Chambers' box, that it might be improved by interlacing the roots of the willow into the uprights of these boxes in place of the points of the pine-tree, which he thought were hardly to be found at the bottom of a river. They were very slippery, and where the point was broken off there was always a resinous flow into the water, which would at once be fatal to the germ. He had put this forward as a suggestion which he hoped would be tried. As an illustration of what swans, geese, and ducks would do he might say that there was a certain nobleman in the south of England who was kind

enough to grant him permission to fish his streams. Some years ago he came to a fine shallow and there found four swans with their heads down going along on the scour. The man who was with him said, "I am afraid you will not get any fish off there to-day;" and his reply was "No; and who is going to get any three years hence?" He drove the swans away, went in and sifted the gravel, and there was not one-tenth part of the ova left; they had gobbled it up by pints, and what was the result? Later on the same nobleman granted him a day's fishing, and, instead of catching fifteen or sixteen pounds of trout, he killed only five takeable fish, and in two years the stream would not be worth throwing a fly upon. They had heard from Professor Huxley that the destruction of man did not matter, and that nature would balance itself. He was willing to grant that with regard to the herring and the cod it might be so, but with regard to the crustacea inshore and trawl fish, which they were not now discussing, he entirely denied it from his own practical observation. He knew of one ledge of rocks on which a family could once gain a livelihood of £6 a week, and it was now not worth fishing.

Mr. WHEELDON, while thoroughly indorsing what had been said with regard to the Paper, confessed to some disappointment that Mr. Marston had not suggested some practical scheme which might be placed in due time before the National Association of Fish Culture, of which he had the honour to be on the Council. He should like to have heard of some thoroughly well-developed scheme for which they might have asked the co-operation and assistance of the Legislature. He had very little belief personally in the idea that the angling clubs of London would be the greater supporters to this scheme, because, unfortunately, however hearty

their sportsman-like spirit might be, they did not develop the great spirit of co-operation. If they did, they might be the most powerful body of men in the kingdom. There was very little doubt that the anglers would be found in overwhelming numbers compared to fox-hunters, pigeon-shooters, coursers, or any other description of sportsmen, and it was inevitable that it should be so, because in a great manufacturing country like England, it was certain that the men who had to spend their lives in hard work, would devote their leisure more frequently to the sport of angling, which had a peaceful tendency. With regard to the introduction of the black bass, he did not gather from what Mr. Goode said, that he desired it to be introduced into any body of water containing salmonidæ, because such a course would be simply suicidal. They might as well let out all the pike and perch of the Avon into some of the Hampshire trout streams, or other waters tenanted by trout, and hope to have the race of trout prosper. He recognised most fully the fact that the black bass was a grand sporting fish, and a good food fish, and a fish which might be of essential use if introduced into such waters as the Serpentine, or some of the ornamental park waters, such as the Welsh Harp and other places of like character. Why the powers that be should debar London anglers from fishing in the Serpentine and other waters of a like character, he did not know, and if they had the black bass thoroughly established, in due time they might have as many black bass clubs as there were in America. With regard to the question of swans on the Thames, he would say a word or two. The previous day he went out fishing on the Thames, and saw to his great regret, that in spite of the immense amount of damage done by swans, not only were the swans on the Thames increasing, but there were absolutely bills

posted prohibiting any one taking the eggs or destroying the young birds. Perhaps that might be necessary, but he did really think the Legislature should be asked to cause the number of swans on the Thames to be reduced to some extent, because they did an immense amount of evil. With regard to the traffic on the Thames, he hoped a bill would soon be passed in Parliament for its better regulation; but he did not think it applied exclusively to launches. No doubt they did a large amount of harm, but it was certain that every boating season, although the anglers of London have very few rights, they were certainly despoiled of them by boating crews continually practising on the Thames. On the previous day he was fishing, when an eight-oared boat of some kind came down, manned by a crew of College boys; Eton boys were grand young fellows, but they were a very great nuisance on the Thames, and to anglers generally all oarsmen were of the same character. These young fellows came down the stream, and though they were not in the way, deliberately rowed smack into the punt, nearly cut their own boat in two, broke two outriggers, and then assailed them with a volley of Eton abuse. It was quite certain the question of anglers' rights and privileges and coarse fish culture was one which ought to receive more attention.

The CHAIRMAN informed the Conference that a bill for regulating steam-launches passed both Houses of Parliament, as he had just been informed by a letter from the Solicitor to the bill. He must say he should like to see the discussion get more practical. If they could persuade the owners of waters to do all they could to produce fish for the pleasure and food of man, it would be a great thing, and his opinion was, that you could fish as much as you liked, provided you fished fairly. With respect

to Mr. Wheeldon's remarks about the swans, there were only three and a-half swans per mile between Richmond and Staines bridge, and he did not think that was a very great excess. They might do some harm of course, as they always would. He looked forward to the time when there would be a society formed, when their own keepers would have authority from the Conservancy to watch and see the boats and launches maintained a fair speed only. He remembered a good many years ago fishing in some splendid waters about five miles from Nuneaton, some hundreds of acres altogether, and saw there lots of small fish which had been taken out with the net lying on the bank dead. It was simply murder, because if that water had been preserved, it would have been a source of pleasure to thousands. He only wished he had that water under his control. If this Paper could be made more public, and the lessons it contained impressed on the minds of those who owned the waters, what a grand thing it would be. He had no hesitation in saying that he could make it pay splendidly, simply by charging a small sum for the privilege of fishing, dealing fairly with people, and laying down proper regulations.

Mr. GEEN had also listened with great pleasure to the Paper; but could not help expressing regret that it did not lead up to some practical issue. No doubt it was Mr. Marston's intention and desire that the discussion should lead to some resolution which would bear fruit, otherwise it would be like many other meetings of anglers, which left the question precisely where they found it. The first thing was, whether it was desirable to cultivate coarse fish. If it was, the next question arose, was it possible; and thirdly, if it was desirable and possible, what were the most practicable means of carrying it out. He did

not think there could be any question in any one's mind who had heard the eloquent speech of the gentleman from Ireland, who referred not only to the importance of these fish as a means of sport, but as food. As to the first point, they were told that the man who made two blades of grass grow where only one grew before, was a benefactor, and the same principle applied to those who not only provided food, but also provided another great need of the labouring classes, and that was some health-giving sport or recreation giving them absolute relaxation from the turmoil of their every day life. He did not think there was any sport within the reach of the working-classes so innocent and health-giving as that of angling, and if it were possible to stock the numerous depleted waters in and around all our large manufacturing centres, it was certainly desirable to do so. As to the question if it were possible —he could not help fancying that people who wrote and talked so much about the Salmonidæ, thought it was equally practicable to reproduce artificial coarse or summer spawning fish; but it was not so. Some four years ago, it was brought forward at a meeting of the Thames Angling Preservation Society by Mr. Benningfield, who asked him (Mr. Geen), to consider it, and it was to be brought forward at the next meeting, but to his surprise the subject dropped; but from a conversation he had had with him, the result was, that it was perfectly practicable to artificially spawn perch; but no other summer spawning fish. The reason was this, the Salmonidæ gave a solid egg, which you could handle, and send to the uttermost parts of the world if necessary; but the spawn of the coarse fish was something you could not handle without destruction. The roach, for instance, deposited their spawn with the greatest care in suitable spots; they would go up day after day with the

intention of shooting the spawn; but if the weather turned dark and cold they would go back again into deep water. Mr. Marston had said that the eggs took seven or eight days to come out; but that was not so. They came out in twenty-four hours in favourable weather,* and that was an instance which showed how impossible it was to deal artificially with these fish except perch. Still, Nature might be assisted, and if they could possibly get a series of ponds partaking somewhat of the nature of a fish farm (because small meddling never came to any good), something might be done. It was all very well to talk of fishery associations, and Mr. Marston had given the tremendous success which attended his box, but it was only a success so far, that the female was there without the male. They must have them both there, or it would not be any good, and that was very much the result with all other boxes. They must put them in the boxes, and a certain proportion would vivify; but they would come out of the holes where the water went in. The only effectual means would be a system of ponds, and it must be taken up by somebody besides the anglers of London. They might give it their support, and no doubt they would; but he should like to see the National Fish Culture Association take up the question. If they would not, what on earth were they constituted for? He hoped that Mr. Marston and others, himself included, would be able to induce the Council to take the matter up, and then the

* I doubt this assertion. I have made inquiries in various directions since I read this Paper, and the result has been to confirm my own statement. The fish do not all spawn at once, and the eggs first deposited of course hatch out soonest. I fancy this fact has misled Mr. Geen, who may have seen the eggs of a first deposit hatching soon after a second or third deposit had taken place.—R. B. M.

anglers of London must put their hands in their pockets and give them proper support.

Mr. SENIOR remarked that some gentlemen seemed to forget that the National Fish Culture Association was at the present moment only in its infancy, and although it was really established to do what they had heard should be done and must be done, up to the present it had had no possible time for formulating a scheme. He must differ from his friend who had preceded him as to Mr. Marston's paper. There was nothing easier than to criticise a paper written and read by another man, but he considered they were all much indebted to Mr. Marston for what he had done, and it was not for him to put his head into a hornet's nest by formulating a scheme for other people to pick to pieces. If there was anything which he hated more than another it was a long speech or a long sermon, and it was a very admirable rule that papers read there should not exceed half an hour. Now in his half hour paper Mr. Marston had given the result of a good deal of study; he had told them what had been done on the continent, and what had been done in this country. There were other papers which would deal with the scientific possibilities of the question of fish culture, and he thought it very wise in Mr. Marston not to attempt a scheme, but to allow scientific men of greater age and experience to put their heads together and furnish the scheme. He had been asked by Mr. Oldham Chambers, secretary to the Fish Culture Association, to apologise for his inability to be present, he having had to go down to Norfolk in order to arrange for a little excursion for the Foreign Commissioners and others to the broads of East Anglia, which teemed with coarse fish, and which he hoped some day would be stocked with black bass. The Angling Preservation Societies, the parent

of which the Chairman represented, had done a great deal towards the culture of coarse fish. Preservation meant culture to a great extent, and the splendid takes of trout registered in the Thames during the present season, of a grand total quite unprecedented, might be considered to be due entirely to preservation. There were some grounds therefore to go upon. The Marquis of Exeter had done something towards the acclimatisation of the bass, and others had acclimatised other kinds of fish. Notwithstanding what Mr. Geen had said he still believed it was as possible to cultivate the carp and tench in ponds, lakes, or rivers, as the perch. The first thing wanted was that the public mind should be educated on this question, and such papers as that now read and as had been read at angling clubs during the past winter, would prepare the ground for the seed which would be sown. The next thing wanted would be the sinews of war, and with regard to that he would only say that Mr. Oldham Chambers would be very happy to receive cheques or contributions, and it would then be for those who had subscribed to the society and supported it to complain if it did not make some progress towards realising what had been promised.

Mr. CRUMPLEN wished to add a word or two with regard to the breeding boxes which had been described by Mr. Marston, and had been used by several anglers. The Fisheries Society resolved to take up the question, and a certain number of the Lund breeding boxes were distributed. One which was tried at Ponders End had proved a perfect success, but he differed from Mr. Geen when he said it was artificial, there was nothing artificial about it beyond this, that it rendered assistance to nature; and if you gave other fish the same assistance—it might not be in a box—but if you provided proper receptacles, and placed

food for the spawn, and took care to give them what nature would give them, he had not the slightest doubt but that similar results would be obtained. To the limited extent to which the culture of coarse fish had been attempted it had been successful, and they should be encouraged to persevere. It was not altogether a question of cost; London anglers had not much to spend, and they might be careful what they spent, but if their money was well spent in an experiment which might not he successful this year, but was likely to be successful in another, he was sure they were sufficiently intelligent to be satisfied with the result. With regard to the black bass, he was not at all opposed to its introduction under certain circumstances, but until their knowledge of it was more complete he thought it desirable to proceed with extreme caution before introducing it to any large extent. His impression was that in this matter they should be very conservative, and not run a risk which at present they were not prepared for. He would warmly advocate the introduction of any fish likely to be useful, but never until it was perfectly certain that it was not going to injure the existing stock.

Dr. SEYMOUR HADEN said a very good illustration of the extreme facility with which coarse fish were bred was shown by the way in which the town of Lyons was furnished with coarse fish before the time of railways. As a boy he was well acquainted with the neighbourhood of Lyons, and in the immediate vicinity there were six lakes one above another. They were never known to have been stocked with fish by anyone, but they were treated in this way. After a certain number of years the lower lake was dragged, and the fish sent to market. The next year the lake above it was drawn, the next year the one above that, and so on until the whole six had been drawn in turn. In every case

the lakes stocked themselves with fresh *ova*, and kept the whole of these six lakes perpetually stocked with vast quantities of coarse fish, carp, bream, tench, and jack, which were taken to Lyons market, and in fact the people of Lyons had no other fish supply whatever. There must be some mistake on the part of those who said that there was great difficulty in propagating coarse fish.

Mr. BRADY, Inspector of Irish Fisheries, then proposed a vote of thanks to Mr. Marston for his very able paper, the importance of which was shown by the lengthy discussion which had arisen. His countryman, Mr. Bloomfield, had shown how important fish culture might be made in certain parts of Ireland as food for the million, and also for the recreation of the large classes of people which could not afford the sport of salmon fishing. Whatever difference of opinion there might be with regard to the difficulties of culture, there could not be any as to the importance of it as a question of food. Mr. Bloomfield had spoken of the spot from whence he could see 27 lakes; he could go to hills from which you could look on 1027 lakes, the whole of which did not provide £5 worth of food, which might be made very valuable if only there were greater facilities for transit, for after all this was the great difficulty.

Mr. WILMOT, Superintendent of Canadian Fisheries, said it afforded him great pleasure to indorse the sentiments contained in the Paper. If anything, it was more desirable to cultivate coarse fish than the higher orders, for, speaking from an experience of 16 or 18 years, the higher orders of fish could not exist without the lower orders. The Almighty, in His providence, had thought proper to put into the same waters fish of high order and of a low order, and it was invariably

found that the high order lived on the low order. If the latter were exterminated, the former would disappear. All the finest salmon rivers had in them certain species of fish of a very low order; they entered the river at a different period to the salmon, to reproduce their species, and the young went down the rivers to the sea, and there in turn were fed upon by the salmon which frequented the same river. It was said by some gentlemen that you could not produce the lower orders of fish, but he maintained that you could produce a thousand to one of the lower orders, because they deposited their ova in the spring months, when the weather was warm, whilst the higher orders deposited theirs in the autumn months, when the weather was cold, and took from three to six or seven months to reproduce, whilst the lower orders were hatched in from three days to three weeks. Consequently nature had given the lower orders the greater preponderance. Throughout nature, as a rule, the lower orders supported the higher, and therefore it became the duty of man to carry out that which Providence had ordained. Carp was a poor man's fish altogether; it could be produced in ponds and small preserves, and ought to be protected and cultivated almost above every other, whilst the salmon and trout were the rich man's fish, because those who sought them had to spend a large amount of money on the sport. With regard to bass, it was a very bad voracious fish to introduce amongst others of a better quality, and he said this coming from a country where it was more famous than in any other part of the world. Where they found the black bass they never found the salmon or trout. There were lakes innumerable in Canada, where the bass, the pike, and other fish of the same character abounded, but they never found in those lakes any of the higher orders of fish. There were

also magnificent rivers, teeming originally with salmon and trout, and they never found black bass in them until lately, when, in consequence of man having killed all the salmon and trout, black bass had been introduced, and in consequence there was nothing but black bass there now. Black bass was a good game fish and a food fish, but they should be put into waters by themselves, or where there was plenty of inferior fish for them to feed upon, but not where they could interfere with better kinds. There was a lake in Canada which teemed with black bass, pike, perch, sunfish, and other of the lower orders, and being a small lake, the temperature in summer was 80° to 90°, and there the black bass abounded; but the inhabitants fished it to such an extent that they exterminated the bass. A petition was sent in to the Legislature about it, and an order was passed that there should be no netting for three years. When that period expired there was an abundance. No one was permitted to spear in it or to net; none but anglers fished it, and there was abundance for all. You never could destroy fish by angling, but in one year they could be destroyed by netting. Still it was no use for an intelligent man to read such an instructive Paper as they had heard to-day, or for other people to discuss it, if men of science, holding the highest positions in the country, told them that it was useless to protect the fish, and that they could take care of themselves. He could only say, if such views were to prevail, the time would come when there would be no fish in Great Britain or any other part of the world.

The resolution having been carried unanimously,

Mr. MARSTON, in reply, said there was no intention whatever to introduce the black bass into trout or salmon streams, any more than they thought of putting the pike

into a trout stream; but there were thousands of acres of water where there were no fish at present, where bass could be put, and would afford magnificent sport. The Sheffield anglers had to go about 30 miles to get their fishing, and every year paid about £15,000 for it, when they might have abundant fishing in their own neighbourhood, if only the streams were populated. With regard to the point mentioned by Mr. Mann, he believed that pine branches were used because they were found to answer admirably, and did not rot; but his suggestion was a very good one, and he hoped next year to try it. Mr. Wheeldon and Mr. Geen had been somewhat disappointed that he had not set forth a more complete scheme, but the scope of this Paper only allowed him to give an outline of the subject. He took it that they considered the matter even more urgent than he did, and no doubt they would help to formulate a scheme and support it. Mr. Geen was right, to a certain extent, in saying that coarse fish could not be cultivated artificially; but in his Paper he had insisted on this fact, and had referred particularly to pond culture, by which means any of these fish could be cultivated. Carp was cultivated to a great extent in Germany, and fetched more money even than sea fish, but he believed other kinds had not been cultivated there, because they were not wanted. There were not many anglers in Germany, and it was for anglers principally that he suggested these fish should be cultivated.

Mr. CROSSMAN moved a vote of thanks to the Chairman, who had been the principal agent in persuading the Conservators of the Thames to prevent the capture of small immature fish. Mr. Wilmot had referred to the opinion expressed on the platform by a gentleman high in the scientific world, but he would say that the great object of

these conferences was to bring together men who were not only scientific but practical, to hear their opinions expressed in the boldest manner possible, so that they might be able to arrive at the truth with regard to any subject connected with fisheries. The salient points in connection with all the fisheries would be thoroughly considered by the most competent men, and he trusted the results would be of the most practical kind. Whoever stood on that platform, whether he were a scientific man, a practical, or a theoretical man, would not, he hoped, be afraid of expressing his opinion on any subject, however antagonistic it might be to the one which seemed to prevail at the moment, because in the end the truth must prevail. The subject brought forward by Mr. Marston was one in which he had taken a great interest, and he might say that the only prize offered at the Exhibition for the cultivation of fish in fresh-water ponds was offered by himself. He saw in Germany and Austria the importance of that cultivation, and in all these matters history seemed to repeat itself. They knew that the ancient Romans were famous for fish culture in ponds. Their tables were provided with carp and every kind of fresh-water fish, and so valuable were they that it was said that one of the fish-ponds of the poet Lucullus actually realised £20,000 after his death. Dr. Seymour Haden had shown what was actually carried on in Lyons, and the same system could be adopted in this country. Wherever there were low-lying meadows, with streams or rivulets running through them, these ponds could be easily constructed. The monks in the olden days, who knew how to place their abbeys in the most lovely spots in creation, also knew which were the most valuable fish, and they always had carp ponds, because they knew it was about the best fresh-water fish, the one most tenacious of life, not carnivorous, but living on weeds and insects. There were

in this country canals of several miles in length, and numerous lakes, utterly devoid of fish, and there were ponds in nearly every field which could, under a wise system, be stocked with fresh-water fish. He was sure this Paper would draw the attention of those who took an interest in these matters to the necessity of cultivating these kinds of fish, and there was no country in the world where it could be cultivated to a more profitable extent than in England, Scotland, and Ireland.

Mr. C. E. FRYER seconded the motion. He did not wish to import a note of discord at the last moment, but he could not miss the opportunity of saying that Mr. Wilmot seemed to have slightly misunderstood the position which Professor Huxley had taken with regard to the question of fisheries. He did not come there as the apologist or defender of Professor Huxley, who was perfectly capable of taking care of himself, but it was most undesirable that any misconception should exist. Professor Huxley held the opinion that, as regards the power of man to interfere with fisheries, they were divisible into three distinct classes; those which might be destroyed, those which could be partially destroyed, and those which we have no proof that it was possible for man to destroy. With regard to the special subject under discussion to-day, Professor Huxley joined the National Fish Culture Association on the ground that it would afford the opportunity of taking up fish culture, more especially with regard to fresh-water fish, that branch being more susceptible of assistance than deep sea fisheries; the fresh-water fish would come under the general category of fisheries that were capable of being destroyed; the littoral fisheries would come under the second category, which it was possible for man to interfere with and seriously injure, if not altogether to destroy, such, for instance, as Lobster, Crab, and Oyster fisheries, and

with regard to Lobster fisheries, Professor Huxley had himself within the last year recommended that very stringent regulations should be enforced on the coast of Norfolk, in the hope that, all the circumstances being very favourable, some general idea might be arrived at as to the effect of restrictive legislation, whether it was really beneficial or not. Coming back to the subject of the Paper, and he regretted he had not been able to attend early enough to listen to it, it appeared to him they should run before they walked, and before taking up difficult and intricate systems of ponds and boxes, and apparatus of various kinds, a great deal might be done by inducing the owners of fish-ponds to treat those fish-ponds exactly as they found them ;* not

* I regret that Mr. Fryer was not present in time to hear my paper, because he would then have seen that my object in advocating coarse-fish culture is, that we can only by this means re-stock the rivers, canals, lakes, ponds, &c., which have been depleted by unfair fishing, over-fishing, and poaching. It will not much assist the thousands of working-men anglers if those gentlemen who have ponds cultivate them again in the way their ancestors did, as referred to in my Paper; how will that help the many thousands of club anglers? They find it usually most difficult to get permission to fish in a private pond, which is often not worth fishing; it would be more hopeless still if the owner of the water had spent money on it in cultivating it. Nor will I admit that the Lund-box, the hurdle, and the system of ponds I described can in any way be fairly designated "intricate." Their simplicity is obvious, for they merely aid nature. Finally, it will be seen Mr. Fryer recommends the German pond system, which in my Paper I had referred to as being by far the best way in which to cultivate coarse fish of all kinds, where some primary expense was not an object (see p. 11 *et seq.*). Of course I do not suppose Mr. Fryer intended to knock my skittles down merely to set them up again himself in this way; but I think it was a pity he deprecated my suggestions without having heard what I had said about them, and then proposed as a substitute the very thing I had advocated most strongly—except that my pond farm would be less "intricate" than those he proposed. I proposed one pond for one kind of fish; his suggestion would require three ponds for each kind of fish.—R. B. M.